

Causes of Post-Concussion Syndrome (PCS):

1. Decreased cerebral blood flow
 - a. Our brains require a 15-20% of all the blood that leaves the heart to supply it with the proper amount of oxygen and nutrients to function properly!
 - b. Do your symptoms increase when you move around (exercise) or when you perform cognitive tasks (thinking hard)? This could be due to a lack of oxygen and nutrients reaching your brain to fuel the demand of these activities.
 - c. Test: Buffalo Treadmill test
 - d. Treatment: Symptom guided exercise routine (cardio -> intervals -> weights)
2. Visual & Vestibular Integration
 - a. The feeling of balance is determined in large part based on our vision and vestibular (inner ear) systems. After a concussion these systems may have difficulty talking to one another which leads to confusion that you perceive as dizziness or fogginess.
 - b. Do your symptoms increase when you move your eyes or turn your head? This could be due to these two systems not talking to each other properly.
 - c. Test: Vestibulo-ocular testing
 - d. Treatment: Symptom guided eye and head rehab exercises
3. Cervical Spine (neck) Dysfunction
 - a. Another system that the brain integrates with our vision and vestibular systems is in our necks. Receptors in your joints and ligaments also tell the brain where your head is, and if this disagrees with your head and inner ears you will also feel dizzy and/or foggy.
 - b. Damage to joints and muscles in our necks can also cause pain that is felt in our heads. This is called referred pain! Your headache may be due to damage of tissues that are not even in your head.
 - c. Do your symptoms increase when you move turn your head or move around?
 - d. Test: Orthopedic and muscle testing of your neck joints, ligaments, and muscles
 - e. Treatment: Manual therapy and rehab exercises
4. Metabolic / Inflammatory / Hormonal Dysregulation
 - a. Metabolic dysregulation = ability of the neurons in our brains to produce energy molecules called ATP to power the cell. (ATP = gasoline for our cells)
 - It is normal for ATP levels to be low for up to 4 weeks following a concussion. It is vital that you do not hit your head again while ATP levels are depleted or you are likely to suffer a second, worse concussion.
 - Test: History – did you hit your head again within 1 month of your original concussion? Have you overexerted yourself following your concussion?

- Treatment: Do not hit your head again until you are healed. Listen to your body, rest when you need to and slowly build back to normal.
 - b. Inflammatory dysregulation = overactivity of our body's healing system.
 - Small amounts of inflammation are normal following an injury and helps us to heal, but sometimes our diet, stress, and other unhealthy habits can lead to an amplified inflammatory response that will actually slow down healing.
 - Test: no direct test available
 - Treatment: Brain recovery diet, anti-inflammatory supplements
 - c. Hormonal dysregulation = decreased activity of the pituitary gland
 - The pituitary gland is a region of the brain that controls the production of many hormones around the body. Decreased activity here may lead to decreased growth hormone production which slow healing following injury.
 - Test: pituitary function test
 - Treatment: hormone supplementation
5. Psychological & Emotional Impact
- a. Our ability to cope with injury and belief that we can heal and become healthy again plays a larger role in recovery than many people believe. There are many physical factors listed above that must be addressed, but factors such as anxiety and depression also have the ability to slow recovery.
 - b. Anxiety causes increases in hormones such as cortisol that slow down healing. These emotions can also make it difficult to sleep and rest as you recover.
 - c. Depression and anxiety may also cause you to avoid appropriate exercise and rehab that is vital for your recovery. Concussion recovery is an active process and occasionally it will increase your symptoms. You must be consistent to navigate the peaks and valleys of recovery!
 - d. It is important to know that:
 - Concussions are treatable and you have a realistic chance to regain a normal life!
 - Symptom exacerbation is an unpleasant experience, but research has not shown links between these symptoms and further damage to neurons or your brain!